

newpatent41602

## CLAIMS

1. A method for analysis comprising:

transmitting electromagnetic radiation through  
5 a plurality of metallic islands on a transparent  
substrate;

measuring a resultant optical property of said  
plurality of metallic islands on said transparent  
substrate;

10 adsorbing a chemical substance onto said  
plurality of metallic islands so as to produce a chemical  
substance-metallic islands moiety on said transparent  
substrate;

transmitting electromagnetic radiation through  
15 said chemical substance-metallic islands moiety;

measuring a resultant optical property of  
metallic islands in said chemical substance-metallic  
islands moiety; and

employing said resultant optical property of  
20 said metallic islands in chemical substance-metallic  
islands moiety and said resultant optical property of  
said metallic islands in said plurality of metallic  
islands so as to provide at least one of a quantitative  
indication and a qualitative indication of at least one  
25 of: said chemical substance-metallic islands moiety, a  
functionality of said chemical substance-metallic islands  
moiety, said plurality of metallic islands, a  
functionality of said plurality of metallic islands, said  
chemical substance and a functionality of said chemical  
30 substance.

2. A method according to claim 1, and wherein adsorbing said chemical substance comprises producing at least one of the following interactions between the chemical substance and said plurality of metallic islands: a hydrogen bond, an ionic bond, a covalent bond, a Van der Waals force, an electrostatic force and a physical force.

3. A method according to claim 1, wherein transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate comprises transmitting electromagnetic radiation in the ultraviolet/visible/infra-red range.

15 4. A method according to claim 1, and wherein transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate comprises transmitting electromagnetic radiation in the range of 300-1100 nm.

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5. A method according to claim 1, and wherein transmitting said electromagnetic radiation through said chemical substance-metallic islands moiety on said transparent substrate comprises transmitting electromagnetic radiation in the ultraviolet/visible/infra-red range.

25 6. A method according to claim 1, and wherein transmitting said electromagnetic radiation through said chemical substance-metallic islands moiety on said

transparent substrate comprises transmitting electromagnetic radiation in the range of 300-1100 nm.

7. A method according to claim 1, and wherein  
5 transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through said transparent substrate comprising at least one of the following: glass, plastic, polystyrene, a  
10 polymeric material, an inorganic oxide, quartz and mica.

8. A method according to claim 1, and wherein  
transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through said transparent substrate having a thickness of  
15 up to 5 mm.

9. A method according to claim 1, and wherein  
20 transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through metallic islands comprising at least one of the following: gold, silver, copper, titanium, vanadium,  
25 chromium, steel, at least one ultra-thin layer of a metal, a binary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium; or a ternary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium.

10. A method according to claim 1, and wherein  
said metallic islands are gold islands.

11. A method according to claim 1, and wherein  
5 transmitting said electromagnetic radiation through said  
plurality of metallic islands on said transparent  
substrate includes transmitting electromagnetic radiation  
through metallic islands having a thickness of up to 400  
angstrom units.

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12. A method according to claim 11, wherein the  
thickness is between 10 to 100 angstrom units.

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13. A method according to claim 1, and employing  
said resultant optical property of said plurality of  
metallic islands comprises measuring a change in a  
surface plasmon absorbance of said plurality of metallic  
islands.

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14. A method according to claim 1, and wherein said  
resultant optical property of said plurality of metallic  
islands comprises a peak of maximal absorbance.

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15. A method according to claim 1, and wherein said  
resultant optical property of said chemical substance-  
metallic islands moiety comprises a peak of maximal  
absorbance.

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16. A method according to claim 1, and wherein said  
resultant optical property of said chemical substance-

metallic islands moiety comprises an absorbance of said chemical substance-metallic islands moiety at a specific wavelength.

5    17.       A method according to claim 1, and wherein measuring a resultant optical property of said chemical substance-metallic islands moiety on said transparent substrate comprises performing real-time measurements of said optical property of said chemical substance-metallic  
10      islands moiety.

18.       A method according to claim 1, and wherein employing said resultant optical property of said chemical substance-metallic islands moiety and said  
15      resultant optical property of said plurality of metallic islands comprises comparing said resultant optical property of said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands.  
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19.       A method according to claim 1, and wherein measuring a resultant optical property of said chemical substance-metallic islands moiety on said transparent substrate comprises performing continuous measurements of  
25      said optical property of metallic islands in said chemical substance-metallic islands moiety.

20.       A method according to claim 1, and wherein measuring a resultant optical property of said chemical substance-metallic islands moiety on said transparent substrate comprises performing kinetic monitoring of said  
30

resultant optical property of metallic islands in said chemical substance-metallic islands moiety.

21. A method according to claim 1, and further  
5 comprising producing the plurality of metallic islands on  
the transparent substrate.

22. A method according to claim 22, and wherein  
producing said plurality of metallic islands producing  
10 said plurality of metallic islands from at least one of  
the following: gold, silver, copper, titanium, vanadium,  
chromium, steel, at least one ultra-thin layer of a  
metal, a binary alloy of the following elements: gold,  
silver, copper, titanium, vanadium, and chromium; or a  
15 ternary alloy of the following elements: gold, silver,  
copper, titanium, vanadium, and chromium.

23. A method according to claim 21 and wherein  
producing said plurality of metallic islands comprises  
20 evaporating said plurality of metallic islands.

24. A method according to claim 21 and wherein  
producing said plurality of metallic islands comprises  
sputtering said plurality of metallic islands.

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25. A method according to claim 21 and wherein  
producing said plurality of metallic islands comprises  
electroless deposition of said plurality of metallic  
islands.

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26. A method according to claim 21 and wherein producing said plurality of metallic islands comprises electrolytic deposition of said plurality of metallic islands.

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27. A method according to claim 21 and wherein producing said plurality of metallic islands comprises hot-melt deposition of said plurality of metallic islands.

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28. A method according to claim 1, and further comprising annealing said plurality of metallic islands on said transparent substrate.

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29. A method according to claim 28, wherein said annealing is performed prior to adsorbing said chemical substance onto said plurality of metallic islands.

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30. A method according to claim 29 wherein annealing said plurality of metallic islands on said transparent substrate comprises heating said plurality of metallic islands on said transparent substrate for up to 24 hours at up to 400 °C.

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31. A method according to claim 30 wherein annealing said plurality of metallic islands on said transparent substrate comprises heating said plurality of metallic islands on said transparent substrate for up to 4 hours at up to 350 °C.

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32. A method for analysis comprising:

producing a plurality of metallic islands on an intermediate layer on a transparent substrate;

5 transmitting electromagnetic radiation through said plurality of metallic islands on said intermediate layer on said transparent substrate;

measuring a resultant optical property of said plurality of metallic islands;

10 adsorbing a chemical substance onto said plurality of metallic islands so as to produce a chemical substance-metallic islands moiety on said intermediate layer on said transparent substrate;

transmitting electromagnetic radiation through 15 said chemical substance-metallic islands moiety;

measuring a resultant optical property of metallic islands in said chemical substance-metallic islands moiety; and

employing said resultant optical property said 20 metallic islands in said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said chemical substance-metallic islands moiety, a functionality of said chemical substance-metallic islands moiety, said plurality of metallic islands, a functionality of said plurality of metallic islands, said chemical substance and a functionality of said chemical substance.

33. A method according to claim 32 and wherein said intermediate layer comprises at least one metal oxide.

34. A method according to claim 33 and wherein said 5 at least one metallic oxide comprises at least one of the following: chromium oxide, titanium oxide, nickel oxide, lead oxide and tin oxide.

35. A method according to claim 32 and wherein said 10 intermediate layer comprises a metal.

36. A method according to claim 32 and wherein said intermediate layer comprises at least one of a nitrogen containing moiety, a sulfur containing moiety and an 15 inorganic hydrogen-containing moiety.

37. A method according to claim 32 and wherein said intermediate layer comprises at least one of the following chemical groups: sulfhydryl, thiocyanate, 20 thiol, sulfide, disulfide and amine.

38. A method according to claim 32 and wherein said intermediate layer comprises an organic layer.

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39. A method according to claim 32, and wherein adsorbing said chemical substance comprises producing at least one of the following interactions between the chemical substance and said plurality of metallic 30 islands: a hydrogen bond, an ionic bond, a covalent bond,

a Van der Waals force, an electrostatic force and a physical force.

40. A method according to claim 32, wherein  
5 transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate comprises transmitting electromagnetic radiation in the ultraviolet/visible/infra-red range.

10 41. A method according to claim 32, and wherein  
transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate comprises transmitting electromagnetic radiation in the range of 300-1100 nm.

15 42. A method according to claim 32, and wherein  
transmitting said electromagnetic radiation through said chemical substance-metallic islands moiety on said transparent substrate comprises transmitting  
20 electromagnetic radiation in the ultraviolet/visible/infra-red range.

25 43. A method according to claim 32, and wherein  
transmitting said electromagnetic radiation through said chemical substance-metallic islands moiety on said transparent substrate comprises transmitting electromagnetic radiation in the range of 300-1100 nm.

30 44. A method according to claim 32, and wherein  
transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent

substrate includes transmitting electromagnetic radiation through said transparent substrate comprising at least one of the following: glass, plastic, polystyrene, a polymeric material, an inorganic oxide, quartz and mica.

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45. A method according to claim 32, and wherein transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through said transparent substrate having a thickness of up to 5 mm.

1000 999 888 777 666 555 444 333 222 111

46. A method according to claim 32, and wherein transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through metallic islands comprising at least one of the following: gold, silver, copper, titanium, vanadium, chromium, steel, at least one ultra-thin layer of a metal, a binary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium; or a ternary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium.

25 47. A method according to claim 32, and wherein said metallic islands are gold islands.

48. A method according to claim 32, and wherein transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation

through metallic islands having a thickness of up to 400 angstrom units.

49. A method according to claim 48, wherein the  
5 thickness is between 10 to 100 angstrom units.

50. A method according to claim 32, and employing  
said resultant optical property of said plurality of  
metallic islands comprises measuring a change in a  
10 surface plasmon absorbance of said plurality of metallic  
islands.

51. A method according to claim 32, and wherein  
said resultant optical property of said plurality of  
15 metallic islands comprises a peak of maximal absorbance.

52. A method according to claim 32, and wherein  
said resultant optical property of said chemical  
substance-metallic islands moiety comprises a peak of  
20 maximal absorbance.

53. A method according to claim 32, and wherein  
said resultant optical property of said chemical  
substance-metallic islands moiety comprises an absorbance  
25 of said chemical substance-metallic islands moiety at a  
specific wavelength.

54. A method according to claim 32, and wherein  
measuring a resultant optical property of said chemical  
30 substance-metallic islands moiety on said transparent

substrate comprises performing real-time measurements of said optical property of said chemical substance-metallic islands moiety.

5   55.       A method according to claim 32, and wherein employing said resultant optical property of said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands comprises comparing said resultant optical 10 property of said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands.

56.       A method according to claim 32, and wherein 15 measuring a resultant optical property of said chemical substance-metallic islands moiety on said transparent substrate of said chemical substance-metallic islands moiety comprises performing continuous measurements of said optical property of said chemical substance-metallic 20 islands moiety.

57.       A method according to claim 32, and wherein measuring a resultant optical property of said chemical substance-metallic islands moiety on said transparent substrate comprises performing kinetic monitoring of said resultant optical property of said chemical substance-metallic islands moiety. 25

58.       A method according to claim 32, and further 30 comprising producing the plurality of metallic islands on the transparent substrate.

59. A method according to claim 59, and wherein  
producing said plurality of metallic islands producing  
said plurality of metallic islands from at least one of  
5 the following: gold, silver, copper, titanium, vanadium,  
chromium, steel, at least one ultra-thin layer of a  
metal, a binary alloy of the following elements: gold,  
silver, copper, titanium, vanadium, and chromium; or a  
ternary alloy of the following elements: gold, silver,  
10 copper, titanium, vanadium, and chromium.

60. A method according to claim 58 and wherein  
producing said plurality of metallic islands comprises  
evaporating said plurality of metallic islands.

15  
61. A method according to claim 58 and wherein  
producing said plurality of metallic islands comprises  
sputtering said plurality of metallic islands.

20 62. A method according to claim 58 and wherein  
producing said plurality of metallic islands comprises  
electroless deposition of said plurality of metallic  
islands.

25 63. A method according to claim 58 and wherein  
producing said plurality of metallic islands comprises  
electrolytic deposition of said plurality of metallic  
islands.

64. A method according to claim 58 and wherein producing said plurality of metallic islands comprises hot-melt deposition of said plurality of metallic islands.

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65. A method according to claim 32, and further comprising annealing said plurality of metallic islands on said transparent substrate.

10 66. A method according to claim 65, wherein said annealing is performed prior to adsorbing said chemical substance onto said plurality of metallic islands.

15 67. A method according to claim 66 wherein annealing said plurality of metallic islands on said transparent substrate comprises heating said plurality of metallic islands on said transparent substrate for up to 24 hours at up to 400 °C.

20 68. A method according to claim 67 wherein annealing said plurality of metallic islands on said transparent substrate comprises heating said plurality of metallic islands on said transparent substrate for up to 4 hours at up to 350 °C.

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69. A method for analysis comprising:

transmitting electromagnetic radiation through a first chemical substance-metallic islands moiety on a transparent substrate;

measuring a resultant optical property of said first chemical substance-metallic islands moiety;

5 communicating said second chemical substance with said first chemical substance so as to form a second chemical substance-first chemical substance-metallic islands moiety;

transmitting electromagnetic radiation through said second chemical substance-first chemical substance-metallic islands moiety on said transparent substrate;

10 measuring a resultant optical property of metallic islands in said second chemical substance-first chemical substance-metallic islands moiety; and

15 employing said resultant optical property of metallic islands in said second chemical substance-first chemical substance-metallic islands moiety and said resultant optical property of said first chemical substance-metallic islands moiety so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said second chemical substance, a functionality of said second chemical substance, said second chemical substance-first chemical substance-metallic islands moiety, a functionality of said second chemical substance-first chemical substance-metallic islands moiety; said first chemical substance-metallic islands moiety, a functionality of said first chemical substance-metallic islands moiety; said plurality of metallic islands, a functionality of said plurality of metallic islands, said first chemical substance and a functionality of said first chemical substance.

70. A method according to claim 69 and wherein said first chemical substance comprises at least one of the following: a chemical ion, an organic molecule, a polymer, an inorganic molecule, an enzyme, a nucleic acid, an antibody, and an antigen.

71. A method according to claim 69 and wherein said second substance comprises at least one of the following: a chemical ion, an organic molecule, an inorganic molecule, a polymer, an enzyme, a nucleic acid, an antibody, and an antigen.

72. A method according to claim 69, and wherein communicating said second chemical substance with said first chemical substance comprises at least one of the following: a physical adsorption; a chemical adsorption; a chemical reaction; a antigen-antibody interaction; a hybridization reaction; an enzyme-substrate interaction; an enzyme inhibitor interaction; an amplification reaction, a polymerase chain reaction; and a precipitation.

73. A method according to claim 69, and wherein communicating said second chemical substance with said first chemical substance comprises producing at least one of the following interactions between the chemical substance and said plurality of metallic islands: a hydrogen bond, an ionic bond, a covalent bond, a Van der Waals force, an electrostatic force and a physical force.

74. A method according to claim 69, wherein transmitting said electromagnetic radiation through said first chemical substance-metallic islands moiety comprises transmitting electromagnetic radiation in the 5 ultraviolet/visible/intra-red range.

75. A method according to claim 69, and wherein transmitting said electromagnetic radiation through said first chemical substance-metallic islands moiety 10 comprises transmitting electromagnetic radiation in the range of 300-1100 nm.

76. A method according to claim 69, and wherein transmitting said electromagnetic radiation through said 15 chemical substance-metallic islands moiety on said transparent substrate comprises transmitting electromagnetic radiation in the ultraviolet/visible/intra-red range.

20 77. A method according to claim 69, and wherein transmitting said electromagnetic radiation through said chemical substance-metallic islands moiety on said 25 transparent substrate comprises transmitting electromagnetic radiation in the range of 300-1100 nm.

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78. A method according to claim 69, and wherein transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation 30 through said transparent substrate comprising at least

one of the following: glass, plastic, polystyrene, a polymeric material, an inorganic oxide, quartz and mica.

79. A method according to claim 69, and wherein  
5 transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through said transparent substrate having a thickness of up to 5 mm.

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80. A method according to claim 69, and wherein  
transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through metallic islands comprising at least one of the following: gold, silver, copper, titanium, vanadium, chromium, steel, at least one ultra-thin layer of a metal, a binary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium; or a  
15 ternary alloy of the following elements: gold, silver,  
20 copper, titanium, vanadium, and chromium.

81. A method according to claim 69, and wherein  
said metallic islands are gold islands.

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82. A method according to claim 69, and wherein  
transmitting said electromagnetic radiation through said plurality of metallic islands on said transparent substrate includes transmitting electromagnetic radiation through metallic islands having a thickness of up to 400  
30 angstrom units.

83. A method according to claim 82, wherein the thickness is between 10 to 100 angstrom units.

5 84. A method according to claim 69, and employing said resultant optical property of said plurality of metallic islands comprises measuring a change in a surface plasmon absorbance of said plurality of metallic islands.

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85. A method according to claim 69, and wherein said resultant optical property of said plurality of metallic islands comprises a peak of maximal absorbance.

15 86. A method according to claim 69, and wherein said resultant optical property of said chemical substance-metallic islands moiety comprises a peak of maximal absorbance.

20 87. A method according to claim 69, and wherein said resultant optical property of said chemical substance-metallic islands moiety comprises an absorbance of said chemical substance-metallic islands moiety at a specific wavelength.

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88. A method according to claim 69, and wherein measuring a resultant optical property of said chemical substance-metallic islands moiety on said transparent substrate comprises performing real-time measurements of

said optical property of said chemical substance-metallic islands moiety.

89. A method according to claim 69, and wherein  
5 employing said resultant optical property of said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands comprises comparing said resultant optical property of said chemical substance-metallic islands  
10 moiety and said resultant optical property of said plurality of metallic islands.

90. A method according to claim 69, and wherein  
measuring a resultant optical property of said chemical  
15 substance-metallic islands moiety on said transparent substrate of said chemical substance-metallic islands moiety comprises performing continuous measurements of said optical property of said chemical substance-metallic islands moiety.

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91. A method according to claim 69, and wherein  
measuring a resultant optical property of said chemical substance-metallic islands moiety on said transparent substrate comprises performing kinetic monitoring of said  
25 resultant optical property of said chemical substance-metallic islands moiety.

92. A method according to claim 69, and further comprising producing the plurality of metallic islands on  
30 the transparent substrate.

93. A method according to claim 92, and wherein  
producing said plurality of metallic islands producing  
said plurality of metallic islands from at least one of  
the following: gold, silver, copper, titanium, vanadium,  
5 chromium, steel, at least one ultra-thin layer of a  
metal, a binary alloy of the following elements: gold,  
silver, copper, titanium, vanadium, and chromium; or a  
ternary alloy of the following elements: gold, silver,  
copper, titanium, vanadium, and chromium.

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94. A method according to claim 92 and wherein  
producing said plurality of metallic islands comprises  
evaporating said plurality of metallic islands.

15 95. A method according to claim 92 and wherein  
producing said plurality of metallic islands comprises  
sputtering said plurality of metallic islands.

20 96. A method according to claim 92 and wherein  
producing said plurality of metallic islands comprises  
electroless deposition of said plurality of metallic  
islands.

25 97. A method according to claim 92 and wherein  
producing said plurality of metallic islands comprises  
electrolytic deposition of said plurality of metallic  
islands.

30 98. A method according to claim 92 and wherein  
producing said plurality of metallic islands comprises

hot-melt deposition of said plurality of metallic islands.

99. A method according to claim 67, and further  
5 comprising annealing said plurality of metallic islands  
on said transparent substrate.

100. A method according to claim 99, wherein said  
annealing is performed prior to adsorbing said chemical  
10 substance onto said plurality of metallic islands.

101. A method according to claim 100 wherein  
annealing said plurality of metallic islands on said  
transparent substrate comprises heating said plurality of  
15 metallic islands on said transparent substrate for up to  
24 hours at up to 400 °C.

102. A method according to claim 101 wherein  
annealing said plurality of metallic islands on said  
20 transparent substrate comprises heating said plurality of  
metallic islands on said transparent substrate for up to  
4 hours at up to 350 °C.

103. Apparatus for analysis comprising:  
25 an adsorption enabling element operative to  
enable adsorption of a chemical substance onto a  
plurality of metallic islands on a transparent substrate  
so as to produce a chemical substance-metallic islands  
moiety;

a transmitter operative to transmit electromagnetic radiation through said plurality of metallic islands; and which is further operative to transmit electromagnetic radiation through said chemical substance-metallic islands moiety;

5 a detector adapted to detect a resultant optical property of said plurality of metallic islands, and further configured to detect a resultant optical property of metallic islands in said chemical substance-  
10 metallic islands moiety; and

15 a processor operative to employ said resultant optical property of said metallic islands in said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said chemical substance-metallic islands moiety, a functionality of said chemical substance-metallic islands moiety, said plurality of metallic islands, a  
20 functionality of said plurality of metallic islands, said chemical substance and a functionality of said chemical substance.

104. Apparatus according to claim 103, and wherein  
25 said adsorption enabling element is operative to produce at least one of the following interactions between the chemical substance and said plurality of metallic islands: a hydrogen bond, an ionic bond, a covalent bond, a Van der Waals force, an electrostatic force and a  
30 physical force.

105. Apparatus according to claim 103, and wherein  
said electromagnetic radiation comprises electromagnetic  
radiation in the ultraviolet/visible/infra-red range.

5 106. Apparatus according to claim 103, and wherein  
said electromagnetic radiation comprises electromagnetic  
radiation in the range of 300-1100 nm.

10 107. Apparatus according to claim 103, and wherein  
said transparent substrate includes at least one of the  
following: glass, plastic, polystyrene, a polymeric  
material, an inorganic oxide, quartz and mica.

15 108. Apparatus according to claim 103, and wherein  
said transparent substrate has a thickness of up to 5 mm.

20 109. Apparatus according to claim 103, and wherein  
said plurality of metallic islands includes at least one  
of the following: gold, silver, copper, titanium,  
vanadium, chromium, steel, at least one ultra-thin layer  
of a metal, a binary alloy of the following elements:  
gold, silver, copper, titanium, vanadium, and chromium;  
or a ternary alloy of the following elements: gold,  
silver, copper, titanium, vanadium, and chromium.

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110. Apparatus according to claim 103, and wherein  
said metallic islands are gold islands.

111. Apparatus according to claim 103, and wherein  
said metallic islands have a thickness of up to 400  
angstrom units.

5 112. Apparatus according to claim 111, and wherein  
the thickness is between 10 to 100 angstrom units.

10 113. Apparatus according to claim 103, and wherein  
said resultant optical property of said plurality of  
metallic islands comprises a change in a surface plasmon  
absorbance of said plurality of metallic islands.

15 114. Apparatus according to claim 103, and wherein  
said resultant optical property of said plurality of  
metallic islands comprises a peak of maximal absorbance.

20 115. Apparatus according to claim 103, and wherein  
said resultant optical property of said chemical  
substance-metallic islands moiety comprises a peak of  
maximal absorbance.

25 116. Apparatus according to claim 103, and wherein  
said resultant optical property of said chemical  
substance-metallic islands moiety comprises an absorbance  
of said chemical substance-metallic islands moiety at a  
specific wavelength.

117. Apparatus according to claim 103, and wherein  
said detector is further operative to perform real-time

measurements of said optical property of said chemical substance-metallic islands moiety.

118. Apparatus according to claim 103, and wherein  
5 said processor is further operative to compare said resultant optical property of said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands.

10 119. Apparatus according to claim 103, and wherein said detector is further configured to perform continuous measurements of said optical property of said chemical substance-metallic islands moiety.

15 120. Apparatus according to claim 103, and wherein said detector is further configured to perform kinetic monitoring of said resultant optical property of said chemical substance-metallic islands moiety.

20 121. Apparatus according to claim 103, and further comprising a metal deposition element operative to produce the plurality of metallic islands on the transparent substrate.

25 122. Apparatus according to claim 121, and wherein said metal deposition element is operative to produce said plurality of metallic islands from at least one of the following: gold, silver, copper, titanium, vanadium, chromium, steel, at least one ultra-thin layer of a metal, a binary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium; or a  
30

ternary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium.

123. Apparatus according to claim 121 and wherein  
5 said metal deposition element is operative to evaporate  
said plurality of metallic islands.

124. Apparatus according to claim 121 and wherein  
said metal deposition element is operative to sputter  
10 said plurality of metallic islands.

125. Apparatus according to claim 121 and wherein  
said metal deposition element is operative to deposit by  
electroless deposition said plurality of metallic  
15 islands.

126. Apparatus according to claim 121 and wherein  
said metal deposition element is operative to deposit by  
electrolytic deposition said plurality of metallic  
20 islands.

127. Apparatus according to claim 121 and wherein  
said metal deposition element is operative to deposit by  
a hot-melt deposition said plurality of metallic islands.  
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128. Apparatus according to claim 121, and further  
comprising a heating element operative to anneal said  
plurality of metallic islands on said transparent  
substrate.

129. Apparatus according to claim 121, and wherein said heating element is operative to heat said plurality of metallic islands for up to 24 hours at up to 400 °C.

5 130. Apparatus according to claim 129, and wherein said heating element is operative to heat said plurality of metallic islands for up to 4 hours at up to 350 °C.

10 131. Apparatus according to claim 121, and wherein said adsorption enabling element is further configured to enable adsorption of an intermediate layer on said transparent substrate.

15 132. Apparatus according to claim 131 and wherein said intermediate layer comprises at least one metal oxide.

20 133. Apparatus according to claim 131 and wherein said at least one metallic oxide comprises at least one of the following: chromium oxide, titanium oxide, nickel oxide, lead oxide and tin oxide.

134. Apparatus according to claim 133 and wherein said intermediate layer comprises a metal.

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135. Apparatus according to claim 131 and wherein said intermediate layer comprises at least one of a nitrogen containing moiety, a sulfur containing moiety and an inorganic hydrogen-containing moiety.

136. Apparatus according to claim 135 and wherein  
said intermediate layer comprises at least one of the  
following chemical groups: sulfhydryl, thiocyanate,  
5 thiol, sulfide, disulfide and amine.

137. Apparatus according to claim 131 and wherein  
said intermediate layer comprises an organic layer.

10 138. Apparatus for analysis comprising:

an adsorption enabling element configured to  
enable adsorption of a chemical substance onto a  
plurality of metallic islands on a transparent substrate  
so as to produce a first chemical substance-metallic  
15 islands moiety; and further to enable adsorption of a  
second chemical substance so as to form a second chemical  
substance-first chemical substance-metallic islands  
moiety;

20 a transmitter operative to transmit  
electromagnetic radiation through said first chemical  
substance-metallic islands moiety and further operative  
to transmit electromagnetic radiation through said second  
chemical substance-first chemical substance-metallic  
islands moiety;

25 a detector operative to detect a resultant  
optical property of metallic islands in said first  
chemical substance-metallic islands moiety, and further  
configured to detect a resultant optical property of  
metallic islands in said second chemical substance-first  
30 chemical substance-metallic islands moiety;

a processor adapted to employ said resultant optical property of said metallic islands in said first chemical substance-metallic islands moiety and said resultant optical property of said of metallic islands in 5 said second chemical substance-first chemical substance-metallic islands moiety so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said second chemical substance, a functionality of said second chemical substance, said 10 second chemical substance-first chemical substance-metallic islands moiety, a functionality of said second chemical substance-first chemical substance-metallic islands moiety; said first chemical substance-metallic islands moiety, a functionality of said first chemical substance-metallic islands moiety; said plurality of 15 metallic islands, a functionality of said plurality of metallic islands, said first chemical substance and a functionality of said first chemical substance.

20 139. Apparatus according to claim 138 and wherein said first chemical substance comprises at least one of the following: a chemical ion, an organic molecule, a polymer, an inorganic molecule, an enzyme, a nucleic acid, an antibody, and an antigen.

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140. Apparatus according to claim 138 and wherein said first second substance comprises at least one of the following: a chemical ion, an organic molecule, an inorganic molecule, a polymer, an enzyme, a nucleic acid, 30 an antibody, and an antigen.

141. Apparatus according to claim 138, and wherein  
said adsorption enabling element is further configured to  
enable communication of said second chemical substance  
with said first chemical substance by means of at least  
5 one of the following: a physical adsorption; a chemical  
adsorption; a chemical reaction; a antigen-antibody  
interaction; a hybridization reaction; an enzyme-  
substrate interaction; an enzyme inhibitor interaction;  
an amplification reaction, a polymerase chain reaction;  
10 and a precipitation.

142. Apparatus according to claim 138, and wherein  
said adsorption enabling element is further configured to  
produce at least one of the following interactions: a  
15 hydrogen bond, an ionic bond, a covalent bond, a Van der  
Waals force, an electrostatic force and a physical force.

143. Apparatus according to claim 138, and wherein  
said electromagnetic radiation comprises electromagnetic  
20 radiation in the ultraviolet/visible/infra-red range.

144. Apparatus according to claim 138, and wherein  
said electromagnetic radiation comprises electromagnetic  
radiation in the range of 300-1100 nm.

25

145. Apparatus according to claim 138, and wherein  
said transparent substrate includes at least one of the  
following: glass, plastic, polystyrene, a polymeric  
material, an inorganic oxide, quartz and mica.

30

146. Apparatus according to claim 138, and wherein  
said transparent substrate has a thickness of up to 5 mm.

147. Apparatus according to claim 138, and wherein  
5 said plurality of metallic islands includes at least one  
of the following: gold, silver, copper, titanium,  
vanadium, chromium, steel, at least one ultra-thin layer  
of a metal, a binary alloy of the following elements:  
gold, silver, copper, titanium, vanadium, and chromium;  
10 or a ternary alloy of the following elements: gold,  
silver, copper, titanium, vanadium, and chromium.

148. Apparatus according to claim 147, and wherein  
said metallic islands are gold islands.

15  
149. Apparatus according to claim 147, and wherein  
said metallic islands have a thickness of up to 400  
Angstrom units.

20 150. Apparatus according to claim 149, and wherein  
the thickness is between 10 to 100 Angstrom units.

151. Apparatus according to claim 138, and wherein  
said detector is further operative to detect a change in  
25 a surface plasmon absorbance.

152. Apparatus according to claim 138, and wherein  
said detector is further operative to detect a peak of  
maximal absorbance.

152. Apparatus according to claim 138, and wherein  
said detector is further operative to detect a spectrum.

153. Apparatus according to claim 138, and wherein  
5 said detector is further operative to detect an  
absorbance of said chemical substance-metallic islands  
moiety at a specific wavelength.

154. Apparatus according to claim 138, and wherein  
10 said detector is further operative to perform real-time  
measurements.

155. Apparatus according to claim 138, and wherein  
said processor is further operative to compare said  
15 resultant optical property of said first chemical  
substance-metallic islands moiety and said resultant  
optical property of said second chemical substance-first  
chemical substance-metallic islands moiety.

20 156. Apparatus according to claim 138, and wherein  
said detector is further configured to perform continuous  
measurements of said optical property of said chemical  
substance-metallic islands moiety.

25 157. Apparatus according to claim 138, and wherein  
said detector is further configured to perform continuous  
measurements of said optical property of said second  
chemical substance-first chemical substance-metallic  
islands moiety.

158. Apparatus according to claim 138, and wherein said detector is further configured to perform kinetic monitoring of said resultant optical property of said first chemical substance-metallic islands moiety.

5

159. Apparatus according to claim 138, and further comprising a metal deposition element operative to produce the plurality of metallic islands on the transparent substrate.

10

160. Apparatus according to claim 159, and wherein said metal deposition element is operative to produce said plurality of metallic islands from at least one of the following: gold, silver, copper, titanium, vanadium, chromium, steel, at least one ultra-thin layer of a metal, a binary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium; or a ternary alloy of the following elements: gold, silver, copper, titanium, vanadium, and chromium.

15

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161. Apparatus according to claim 159, and wherein said metal deposition element is operative to evaporate said plurality of metallic islands.

25

162. Apparatus according to claim 159, and wherein said metal deposition element is operative to sputter said plurality of metallic islands.

30

163. Apparatus according to claim 159, and wherein said metal deposition element is operative to deposit by

electroless deposition said plurality of metallic islands.

164. Apparatus according to claim 159 and wherein  
5 said metal deposition element is operative to deposit by  
electrolytic deposition said plurality of metallic islands.

165. Apparatus according to claim 159 and wherein  
10 said metal deposition element is operative to deposit by  
a hot-melt deposition said plurality of metallic islands.

166. Apparatus according to claim 138, and further  
comprising a heating element operative to anneal said  
15 plurality of metallic islands on said transparent  
substrate.

167. Apparatus according to claim 166, and wherein  
said heating element is operative to heat said plurality  
20 of metallic islands for up to 24 hours at up to 400 °C.

168. Apparatus according to claim 167, and wherein  
said heating element is operative to heat said plurality  
of metallic islands for up to 4 hours at up to 350 °C.

25  
169. Apparatus according to claim 138, and wherein  
said adsorption enabling element is further configured to  
enable adsorption of an intermediate layer on said  
transparent substrate.

170. Apparatus according to claim 169 and wherein said intermediate layer comprises at least one metal oxide.

5 171. Apparatus according to claim 170 and wherein said at least one metallic oxide comprises at least one of the following: chromium oxide, titanium oxide, nickel oxide, lead oxide and tin oxide.

10 172. Apparatus according to claim 169 and wherein said intermediate layer comprises a metal.

15 173. Apparatus according to claim 169 and wherein said intermediate layer comprises at least one of a nitrogen containing moiety, a sulfur containing moiety and an inorganic hydrogen-containing moiety.

20 174. Apparatus according to claim 173 and wherein said intermediate layer comprises at least one of the following chemical groups: sulphydryl, thiocyanate, thiol, sulfide, disulfide and amine.

175. Apparatus according to claim 169, and wherein said intermediate layer comprises an organic layer.

25

176. A kit for analysis comprising:

a plurality of metallic islands on a transparent substrate;

5           a transmitter configured to transmit electromagnetic radiation through said plurality of metallic islands on said transparent substrate, and further configured to transmit electromagnetic radiation through a chemical substance-metallic islands moiety on said transparent substrate;

10          a detector adapted to detect a resultant optical property of said plurality of metallic islands, and further configured to detect a resultant optical property of metallic islands in said chemical substance-metallic islands moiety; and

15          a processor configured to employ said resultant optical property of said metallic islands in chemical substance-metallic islands moiety with and resultant optical property of said plurality of metallic islands so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said chemical substance-metallic islands moiety, a functionality of said chemical substance-metallic islands 20 moiety, said plurality of metallic islands, a functionality of said plurality of metallic islands, said chemical substance and a functionality of said chemical substance.

25         177.       A kit for analysis comprising:

30          a first chemical substance adsorbed onto plurality of metallic islands on a transparent substrate so as to form a first chemical substance-metallic islands moiety; and wherein said first chemical substance-metallic islands moiety is configured to bind a second chemical substance so as to form a second chemical

substance-first chemical substance-metallic islands moiety;

a transmitter operative to transmit electromagnetic radiation through said first chemical 5 substance-metallic islands moiety and which is further operative to transmit electromagnetic radiation through said second chemical substance-first chemical substance-metallic islands moiety;

10 a detector adapted to detect a resultant optical property of metallic islands in said first chemical substance-metallic islands moiety, and further configured to detect a resultant optical property of metallic islands in said second chemical substance-first chemical substance-metallic islands moiety;

15 a processor adapted to employ said resultant optical property of said metallic islands in said chemical substance-metallic islands moiety and said resultant optical property of said metallic islands in said second chemical substance-first chemical substance-20 metallic islands moiety so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said second chemical substance, a functionality of said second chemical substance, said second chemical substance-first chemical substance-25 metallic islands moiety, a functionality of said second chemical substance-first chemical substance-metallic islands moiety; said first chemical substance-metallic islands moiety, a functionality of said first chemical substance-metallic islands moiety; said plurality of metallic islands, a functionality of said plurality of metallic islands, said first chemical substance and a functionality of said first chemical substance.

178. An optical sensor for analysis comprising:

a plurality of metallic islands on a transparent substrate;

5 a transmitter configured to transmit electromagnetic radiation through said plurality of metallic islands on said transparent substrate, and further configured to transmit electromagnetic radiation through a chemical substance-metallic islands moiety on said transparent substrate;

10 a detector adapted to detect a resultant optical property of said plurality of metallic islands, and further configured to detect a resultant optical property of metallic islands in said chemical substance-metallic islands moiety; and

15 a processor adapted to employ said resultant optical property of said metallic islands in said chemical substance-metallic islands moiety and said resultant optical property of said plurality of metallic islands so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said chemical substance-metallic islands moiety, a functionality of said chemical substance-metallic islands moiety, said plurality of metallic islands, a functionality of said plurality of metallic islands, said 20 chemical substance and a functionality of said chemical substance.

179. An optical sensor for analysis comprising:

30 a first chemical substance adsorbed onto plurality of metallic islands on a transparent substrate

so as to form a first chemical substance-metallic islands moiety;

5           a transmitter configured to transmit electromagnetic radiation through said first chemical substance-metallic islands moiety on said transparent substrate, and further configured to transmit electromagnetic radiation through said second chemical substance-first chemical substance-metallic islands moiety on said transparent substrate;

10           a detector adapted to detect a resultant optical property of metallic islands in said first chemical substance-metallic islands moiety, and further configured to detect a resultant optical property of metallic islands in said second chemical substance-first chemical substance-metallic islands moiety; and

15           a processor adapted to employ said resultant optical property of said metallic islands in said chemical substance-metallic islands moiety and said resultant optical property of said metallic islands in said second chemical substance-first chemical substance-metallic islands moiety so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said second chemical substance, a functionality of said second chemical substance, said second chemical substance-first chemical substance-metallic islands moiety, a functionality of said second chemical substance-first chemical substance-metallic islands moiety; said first chemical substance-metallic islands moiety, a functionality of said first chemical substance-metallic islands moiety; said plurality of metallic islands, a functionality of said plurality of metallic islands, said first chemical substance and a functionality of said first chemical substance.

180. A computer program product for analysis, the product comprising a computer-readable medium having program instructions embodied therein, which  
5 instructions, when read by a computer, cause the computer to:

transmit electromagnetic radiation through a plurality of metallic islands on a transparent substrate;

10 measure an optical property of a plurality of metallic islands on a transparent substrate;

adsorb a chemical substance onto said plurality of metallic islands so as to produce a chemical substance-metallic islands moiety on said transparent substrate;

15 transmit electromagnetic radiation through said chemical substance-metallic islands moiety;

measure an optical property of metallic island in said chemical substance-metallic islands moiety; and

20 compare said optical property of metallic islands in said chemical substance-metallic islands moiety with said optical property of said plurality of metallic islands so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said chemical substance-metallic islands  
25 moiety, a functionality of said chemical substance-metallic islands moiety, said plurality of metallic islands, a functionality of said plurality of metallic islands, said chemical substance and a functionality of said chemical substance.

181. A computer program product for analysis, the product comprising a computer-readable medium having program instructions embodied therein, which instructions, when read by a computer, cause the computer  
5 to:

transmit electromagnetic radiation through a first chemical substance-metallic islands moiety;

10 measure an optical property of said first chemical substance-metallic islands moiety on a transparent substrate;

communicate said second chemical substance with said first chemical substance so as to form a second chemical substance-first chemical substance-metallic islands moiety;

15 transmit electromagnetic radiation through said second chemical substance-first chemical substance-metallic islands moiety;

20 measure said optical property of metallic islands in said second chemical substance-first chemical substance-metallic islands moiety; and

25 compare said optical property of said metallic islands in said second chemical substance-first chemical substance-metallic islands moiety with said optical property of said first chemical substance-metallic islands moiety so as to provide at least one of a quantitative indication and a qualitative indication of at least one of: said second chemical substance, a functionality of said second chemical substance, said second chemical substance-first chemical substance-  
30 metallic islands moiety, a functionality of said second chemical substance-first chemical substance-metallic islands moiety; said first chemical substance-metallic

islands moiety, a functionality of said first chemical substance-metallic islands moiety; said plurality of metallic islands, a functionality of said plurality of metallic islands, said first chemical substance and a 5 functionality of said first chemical substance.